OUTLOOK FOR RUBBER

focus

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Outlook for Rubber

During the past fifty years rubber has become one of the vital raw materials of our civilization, a key commodity in such essentials as aviation, communication, health, recreation, and, above all, transportation. More than two-thirds of all the rubber consumed in the United States today is devoted to keeping men and goods on the move. And increasing technological discoveries are constantly finding new ways of using rubber. One of the latest is the application of a mixture of rubber and asphalt to the top surface of roads to make them more durable and reduce skidding. Several hundred types of synthetic rubber have been developed, each with special characteristics and qualities—resistance to oxygen, solvents, oils, acids, or weathering.

Europe first heard about rubber when Columbus returned from the Americas with tales of a strange substance, derived from the sap of a tree, that the natives used for balls and ornaments. Rubber was not considered of much practical use, however, until the discovery of waterproofing by Macintosh in 1833 and vulcanization by Goodyear in 1839, and, even more important, the invention of pneumatic tires by Dunlop in 1888.

Until 1876 the rubber tree was confined to the Amazon Basin, where it was jealously guarded by the Brazilian government, but in that year Henry A. Wickham, an English coffee planter, smuggled seeds of the tree *(Hevea brasiliensis)* out of the country and took them to England, where they were planted in the Royal Botanic Gardens near London. Later transplanted to Southeast Asia, the trees formed the basis for the plantations and small native holdings that now produce 93 per cent of the world's natural rubber. Though enormous efforts were made during World War II to develop the rubber areas of the Amazon Basin, Brazil never regained its former supremacy, and today Latin America's exports of rubber are insignificant.

The story of synthetic rubber is not as well known. It was developed not by any one man or any one nation; rather, over a period of seventy years, chemists of Great Britain, France, Germany, Russia, and the United States each contributed to its discovery. In 1879 a Frenchman, G. Bouchardat, produced a substance that had elasticity and some of the other properties of rubber, and he was the first to suggest that rubber is a polymer, a substance in which the original molecules have linked together to form giant molecules. Subsequent experiments were carried out largely by Europeans until 1908, when Henry Ford's Model T skyrocketed the world's demand for cheap tires (natural rubber was then selling for $3.00 a pound!). World War I found both Germans and Rus-

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sians in a desperate search for a synthetic, since both were cut off from their normal sources of natural rubber. By 1915 the Germans were operating a synthetic plant with a capacity of 150 tons a month; but the process was long and expensive, the product inferior—so inferior that vehicles using solid tires made of this rubber had to be jacked up when not in operation to keep the tires from developing flat spots.

Some progress was made between wars, and both Germany and the Soviet Union produced a little synthetic rubber for domestic use. But it was the United States that suddenly emerged, in the early years of World War II, as the world's greatest synthetic rubber producer.

At the time of Pearl Harbor the United States had on hand less than a year's supply of natural rubber at *normal* rates of consumption. Military demand for rubber was so urgent that little time could be spent on additional research, plant designing, or technological processes, but the years of European and American research had laid the foundations of the new industry. Within fifteen months it was in full swing, and the nation was no longer solely dependent upon natural rubber. Within four years, 1941 to 1945, United States consumption of synthetic rubber climbed from 6,000 tons to more than 750,000.

Independent companies supplied the engineering skill, but the project was planned, coordinated, financed, supervised, and controlled by the government. Altogether, fifty-one plants were constructed through the joint efforts of the government and private enterprise, at an estimated cost of 750 million dollars. Shortly after the war, twenty-four of the plants were sold to private companies; the other twenty-seven remained in government ownership until May, 1955, when most of them were sold.

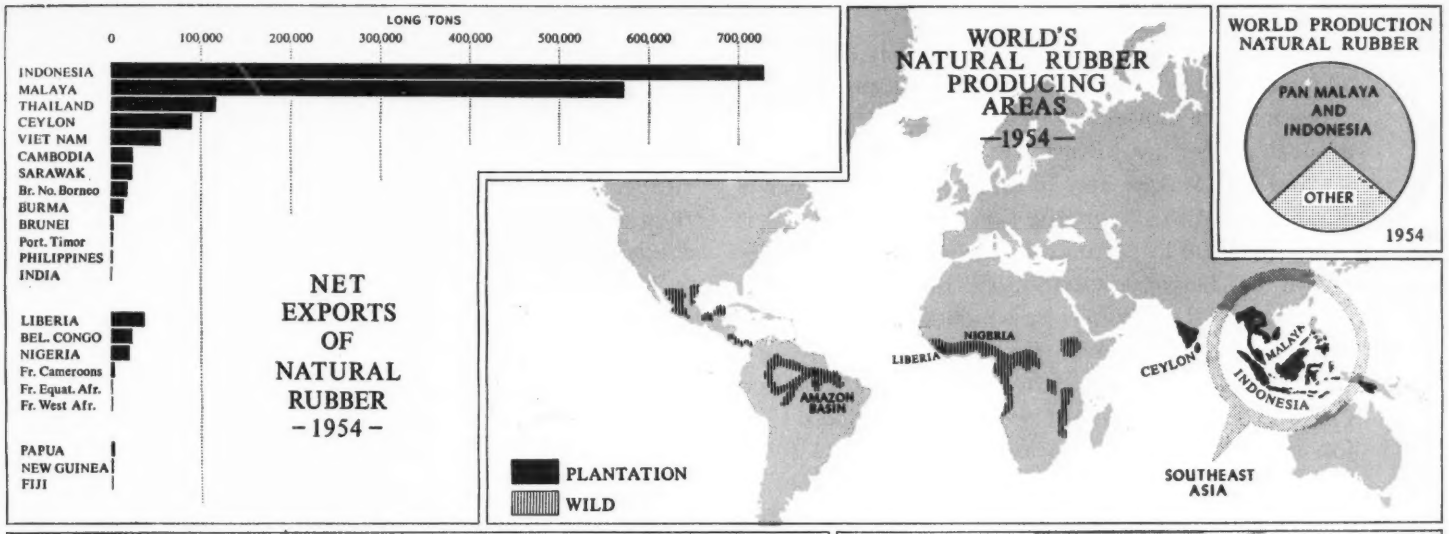
The over-all price of synthetic rubber has been low and fairly constant since 1944, whereas that of natural rubber has been consistently higher and unsteady, a factor that has influenced many manufacturers to shift to synthetic rubber as a basic material. During the last thirty years natural rubber has ranged in price from 3 cents a pound to $1.25; synthetic rubber, on the other hand, has fluctuated, during the period of commercial production, only from 18.5 cents a pound to 25 cents. The current price of natural rubber is 46 cents a pound (No. 1 RSS, f.o.b. New York, August, 1955), whereas general-purpose synthetic rubber (Buna-S) sells for 23 cents.

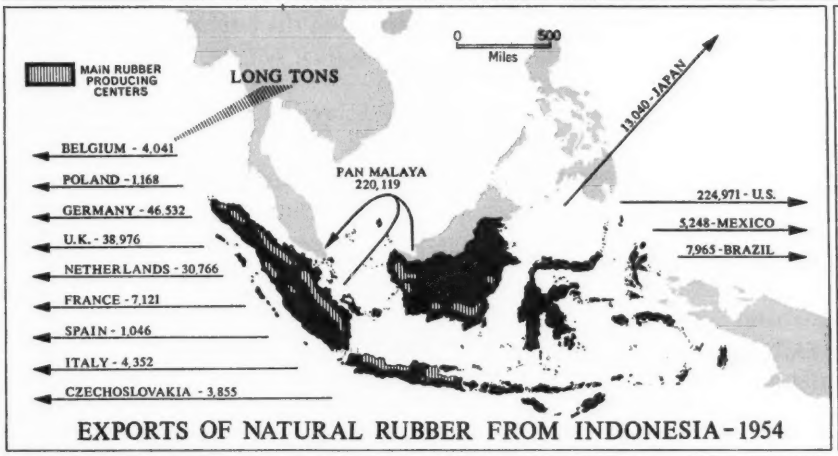
Nearly three-quarters of the world's natural rubber comes from the Federation of Malaya and the Republic of Indonesia. For many years Singapore functioned as the milling and distributing center for the whole of Southeast Asia, but since World War II most countries, with the exception of Indonesia, are milling and distributing their own rubber products. Rubber investors, everywhere deeply concerned about the future of free world production in troubled Southeast Asia, have been spreading their operations into Africa. One of the largest British manufacturers, for instance, which has plantations in Malaya, has recently announced plans to establish additional ones in Nigeria. And this year the B. F. Goodrich Company was the last of the American "big four" to obtain concessions for a rubber plantation in Liberia.

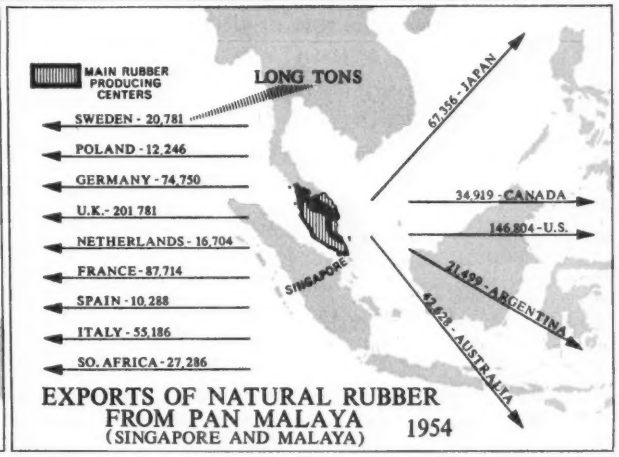
Though Great Britain, France, and Italy plan to construct synthetic plants, and other countries are considering doing so, at present all of the world's synthetic rubber is made in the United States, the Federal Republic of Germany, Canada, the Soviet Union, and probably the German Democratic Republic. United States production reached 622,852 long tons in 1954, or 87 per cent of the world total outside the Iron Curtain. (In 1949, the last date for which figures are available from communist-controlled countries, the United States produced 65 per cent of the world total, the USSR 26, Canada 5, and Eastern Germany 4.)

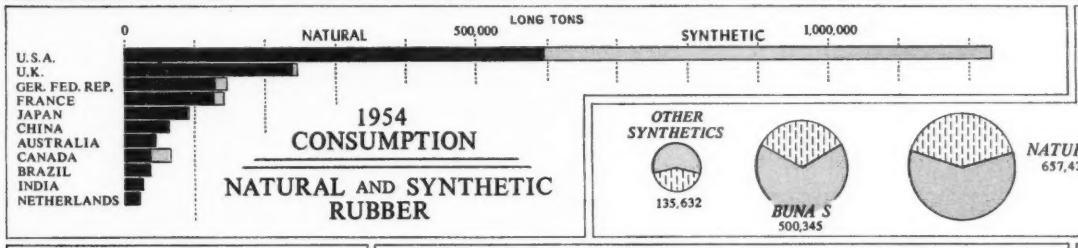
Despite the tremendous increase in United States production of synthetic rubber, we are still the world's largest consumer of natural rubber, using about 33 per cent of the total; Great Britain, the second largest, uses 13 per cent. For several reasons, the immediate postwar period saw a shift back in favor of natural rubber in the United States. First, the public tended not to use synthetics because of the proverbial resistance to change. Second, synthetics at that time were not as good as the natural product in some respects. And third, manufacturers lacked training in processing techniques. But in 1949, fearing a recurrence of the wartime shortage, the government established controls to conserve natural rubber and stimulate the use of synthetics. Manufacturers of rubber goods were required to include a certain percentage of synthetic rubber in their products. Through such action the government probably saved the huge synthetic industry from collapse.

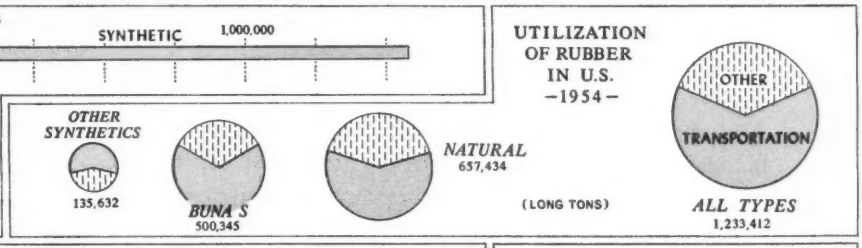
No one of the four major types of synthetic rubber —Buna-S, Butyl, neoprene, and Buna-N—is superior to natural rubber for general purposes, but certain

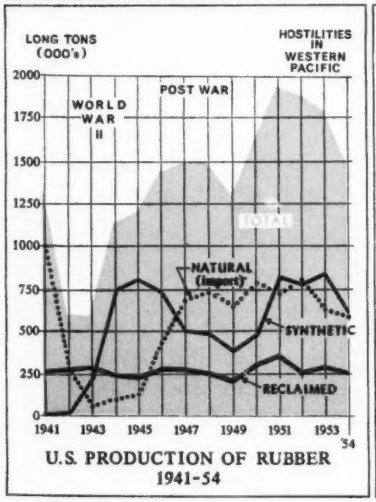


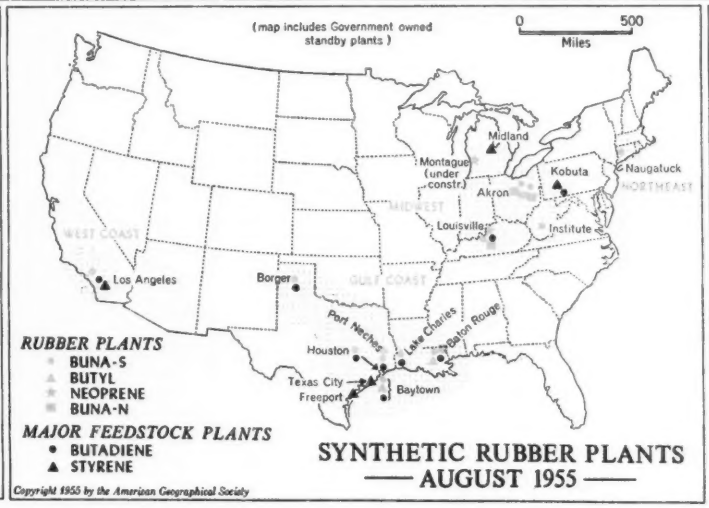


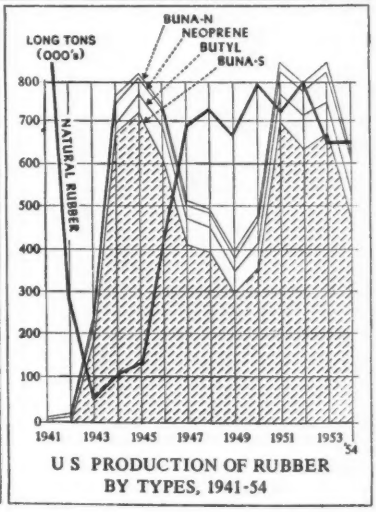












Maps drawn by Vincent Kotschar

types are superior for given purposes. Slightly more than three-quarters of all the rubber used in this country (synthetic, natural, and reclaimed) is the general-purpose Buna-S. A tire made of Buna-S has one-third greater wearing quality than a thicker tread made of natural rubber; production cost is four cents a pound less.

Butyl, the most inexpensive of the synthetics, is used almost exclusively for inner tubes, since it has the unique property of retaining air ten times longer than tubes made of natural rubber.

Neoprene has many properties approximating those of the natural product. It is used largely in electrical insulation because of its outstanding performance in resisting heat, oil, oxidation, and flames.

Buna-N, the most expensive type (about 50 cents a pound), tends to blend easily with natural and other synthetic rubbers and is resistant to hydrocarbons, including oil, gasoline, and aromatic solvents, and to abrasion, heat, and age.

The primary materials used in making synthetic rubber are petroleum, coal, natural gas, and industrial alcohol. Butadiene and styrene, products of petroleum and coal respectively, which are used for Buna-S, constitute the major feedstocks. Butadiene is usually produced by petroleum companies, styrene by chemical companies. Since it is not economically sound to ship butadiene great distances, and since butadiene is used almost exclusively for rubber, the feedstock plants, with a few exceptions, form part of a local industrial complex consisting of the petroleum refinery (supplying the basic raw materials), the butadiene plant, and the rubber producing plant. The flow of materials between plants is usually by pipeline.

Though it costs three times as much to process butadiene from grain and potato alcohol as to get it from petroleum, nevertheless this was done by the Americans during World War II, when petroleum was scarce. The huge plant at Institute, W. Va., at that time processed daily about 76,000 bushels of corn into butadiene, and even grapes were brought from France to make butadiene. In Europe, because of the chronic shortage of petroleum, the synthetic-rubber industry is based largely upon the processing of grain, potatoes, and similar products. In the Soviet Union potatoes are primarily used.

Styrene, the second major material used for Buna-S, is consumed in smaller quantities than butadiene and is shipped across the country by tank car to the rubber-producing plants.

The distribution of the synthetic-rubber industry in the United States is influenced to a large extent by the close integration of the petroleum, chemical, and rubber-products industries. In the area of greatest

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concentration, along the Gulf Coast from Baton Rouge, La., to Houston, Tex., the sixteen plants now operating are oriented to local petroleum refineries. The seven Buna-S plants in this area, which are equipped to make almost three-quarters of all the nation's Buna-S, produce dry rubber (as opposed to the latex form) and ship it to markets in trucks and boxcars. Most of the rubber made on the Gulf Coast goes to the Midwest.

The high water content of latex rubber makes it uneconomical to ship it great distances, and the Midwest, Northeast, and West Coast each produce the latex for local markets. The Midwest area has ten plants, plus two government-owned stand-by plants based on the utilization of alcohol. Locations close to the Midwest grain supply were of utmost importance when these alcohol-consuming factories were built, but now they are too far from present sources of petroleum butadiene. The three Buna-S plants in the area can produce 12 per cent of our Buna-S, but they are competing with similar plants on the Gulf Coast, and they are handicapped by the distances separating them from the low-cost butadiene producers and by the high cost of Midwestern utilities. These disadvantages, however, are partly offset by their nearness to the center of the rubber-compounding industry and by the production of specialty rubber.

Only one small rubber plant, which makes Buna-S, is located in the Northeast, at Naugatuck, Conn., and orientation is to the large local rubber market. None of the feedstock materials are made in the vicinity.

Rubber manufacturers on the West Coast are closely integrated around Los Angeles, the styrene, butadiene, and rubber plants being interconnected by pipelines. Another 12 per cent of our Buna-S comes from this area, which produces both dry and latex rubbers.

According to "Resources for Freedom," a report prepared by the President's Materials Policy Commission, the consumption of rubber in the United States may be expected to grow continuously and possibly reach 3.3 million tons by 1975, more than double present consumption. Reclaimed rubber might provide about one-fourth of this; the supply of new rubber, therefore, must be 2.5 million tons a year. How much of this will be synthetic, how much natural rubber? The present capacity of our synthetic plants is well over one million tons, and it can be expanded. On the other hand, there appear to be two factors encouraging the continued use of natural rubber in the United States.

First, many products are made from natural rubber because it is superior to synthetic for these particular products. For example, large truck tires are still made

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